SUPPRESSION AND SUBSTITUTION AS A FACTOR IN SEX DIFFERENCES[1]

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Among the factors which influence the rate and efficiency of mental association is the tendency toward suppression and substitution. That the strength of this tendency constitutes a distinct sex difference, being stronger in women than in men, is indicated by the results of tests which are here reported.

The subjects were 12 women and 16 men, students in a psychological laboratory. Each had had an elementary course in psychology and had worked a term and a half in the laboratory. They were, therefore, especially good subjects.

The tests used were selected from the Woodworth and Wells association tests. They fall into two groups. The first group included the two cancellation tests, the two naming tests, the substitution test and the two directions tests. All the tests were made under the supervision of the director of the laboratory. In each series of the first group, the first test was given to a student by the director. This student was then instructed how to perform the test and he gave it under supervision to the other 27 subjects. The logical relation tests, which constituted the second group which were given by Dr. Kempf included the opposites test, the verb object test, the action-agent test, the attribute-substance test, the subordinate concept test, the agent-action test, and a reverse opposites test. The latter was made up by selecting the true opposites of the Woodworth and Wells list of forty-opposites. This test was given by Miss Mitchell under Dr. Kempf's direction. In the logical relation tests each stimulus word was pronounced by the experimenter and the subject responded orally. The oral reaction word and reaction time were individually recorded.

In the logical relation series the time was taken with a stop watch. The same was true of the other series excepting where the time was long. In those cases an ordinary watch was used. The same method was used throughout each series so that within a given series each test had the same degree of accuracy.

[1] From the Psychological Laboratory of Indiana University.

The tests were first undertaken for practice work. Care was taken from the first, however, to see that all the conditions were thoroughly standardized so that the results would be reliable. When the first seven series were completed it seemed worth while to gather the results into a table separating the men and women into different groups. When this was done there appeared a distinct sex difference in favor of the women. This difference occurred not only as concerns the whole set of tests but it appeared in each separate series. The per cent of difference ranged from 8% in the Form naming test to 15% in the Cancellation of 2 test.

In discussing these results with the subjects it was suggested that the women might have made more errors than the men and thus increased their time. It was possible at the time to make an examination of the results of the cancellation tests and of the easy directions test only. In both of these there were more errors for the men. It does not seem probable therefore that the superiority of the women was due to careless work.

A second suggestion was that the greater length of time occupied by the men was due to wide individual variation. This would be individual rather than sex difference. In figuring the average for the whole group of tests it was found that the M.V. for the men was slightly greater than for the women, 13.5″ for the latter as against 16.5″ for the former. The number of wide variations, however, were about equally distributed between plus and minus variations so that we do not seem to find the explanation here.

The apparent sex differences might be attributable to the women being a more highly selected group than the men. In order to test this hypothesis the grades of all were obtained from the University office. All the grades in all the subjects for all the time the students were in college were considered. The average for the women was 86.96 and for the men 84.72. This difference in favor of the women thus correlates very closely with the difference shown in this series of tests. We may, therefore, conclude that the women did better in this series of tests because they were a better selected group.

Whatever may be the explanation of this apparent sex difference the fact that such a difference occurs serves to make conspicuous *the opposite results obtained in the logical relation tests. Here the rate of efficiency is in favor of the men and against the women.* This difference is made apparent by the two charts of curves.

In each of the group I tests the women use less time; in each of the logical relation tests they use more time. The reversal of superiority is so complete and so striking as to deserve consideration.

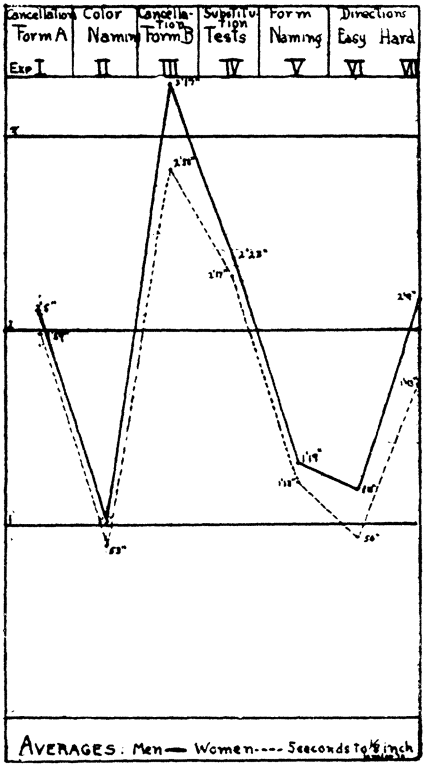

Figure I. Solid line, average of 16 men; broken line, average of 12 women. Distance on ordinates indicate time in seconds occupied in completing entire task. *Women excel men in each test.*

The factors which influence the rate of association are so numerous that variations in reaction rate are to be expected. These influences are found in these experiments but it is difficult to see why any one of them or all of them together would so operate as to produce the exact reversal of sex differences that appear. Thus a possible cause of the reversal

might be the method of experimental procedure. This, however, was standardized for each test at the beginning and remained the same for that series throughout. Men and women were treated alike. The position at the table, the

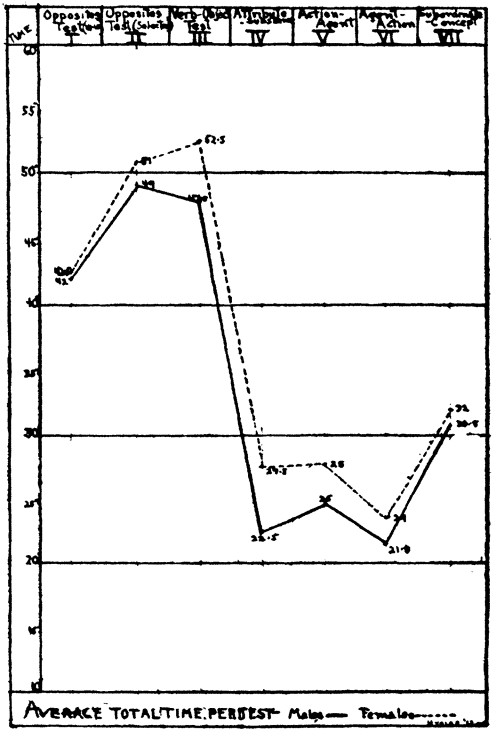

Figure II. Solid line, average of 16 men; broken line, average of 12 women. Distance on ordinates indicates time in seconds occupied in completing entire task. *Men excel women in each test.*

instructions at the beginning, the manner of presenting the stimulus, the recording of time remained the same for all subjects in a given test.

A second cause might have been the unfamiliarity of material. The subjects were mostly college juniors, seniors, and graduates. The simple material used in the tests must have had practically the same familiarity to all. This may

have been slightly less true of the logical relations tests. Yet even here the associations called for are all so commonplace that the occasional unfamiliarity reported by one or more subjects could not have greatly altered the total results.

A third possible cause might have been the attitude of the subjects toward the experiment. It might have been that the women were more interested in the Group I tests and the men more alert in the logical relations test. There does not, however, seem any valid ground for assuming this in these tests. All the subjects were seriously minded in the experiments and understood from the beginning that it was important to do the work rapidly. While there may have been individual variations from test to test it seems quite improbable that either sex should have a change of attitude sufficient to account for the changed results.

A fourth possibility is that the personality of the experimenter might have affected the subjects differently and thus altered the rate of efficiency. It is to be noted, however, that in the Group I tests there were seven experimenters all producing the same results, and in the logical relations test there were two experimenters, one man and one woman, both securing like results and results diametrically opposed to the results of the first seven. In fact the reverse opposites test was devised and given to a woman to make the tests with the aim to see if the experimenter in the logical relations tests was the cause of the reversal. The results from this test, however, were in harmony with the results of Dr. Kempf. It, therefore, seems safer to look elsewhere for the cause of the difference.

If one turns from these general conditions, none of which seems adequate as an explanation of the differing results obtained from the two sets of tests, to an analysis of the results of the logical relations tests he finds as one outstanding fact the presence of confusion as evidenced by lengthened reaction times. This lengthening of reaction was frequently several times the normal average reaction. Thus one subject whose normal time was one second consumed 5.8″ in responding to the word *win*. In such a case one reaction was practically the equivalent of six and it became necessary in computing the normal average to devise a method for eliminating such unusual reactions. For such elimination the following rough method was adopted. First the average of the series was found. To this average was added twice the average varia-

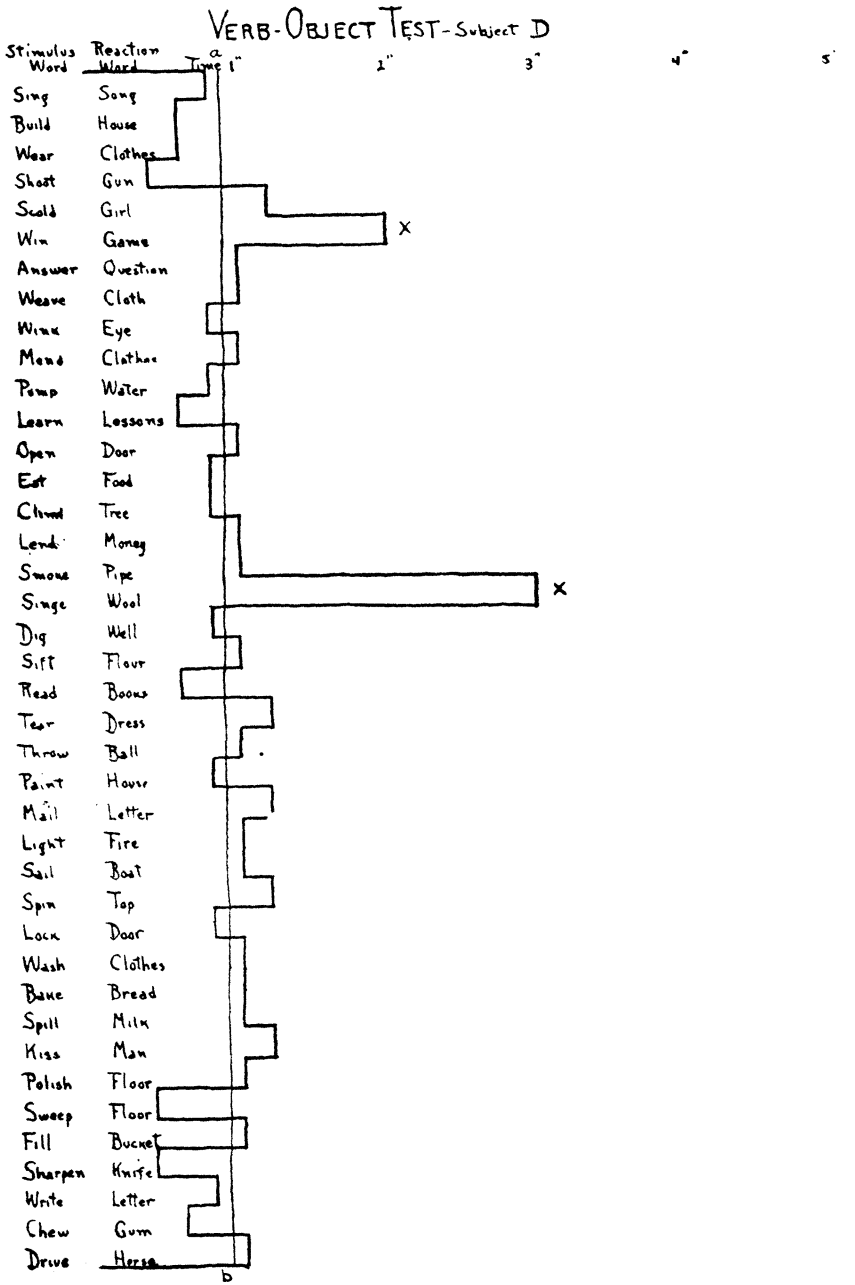

Figure III. A page showing method of recording reactions and the process of eliminating abnormal reactions. The line ab marks the average. The two reactions marked X were eliminated in making the second average which is the basis of the curve in figure II.

tion as determined by estimation.[2] All reactions exceeding this time were eliminated as abnormal. For the others a new average was found which was counted as the normal average for the individual in question. This average which is the basis of the curve on page 417 does not, therefore, involve those reactions which were highly costly in time.

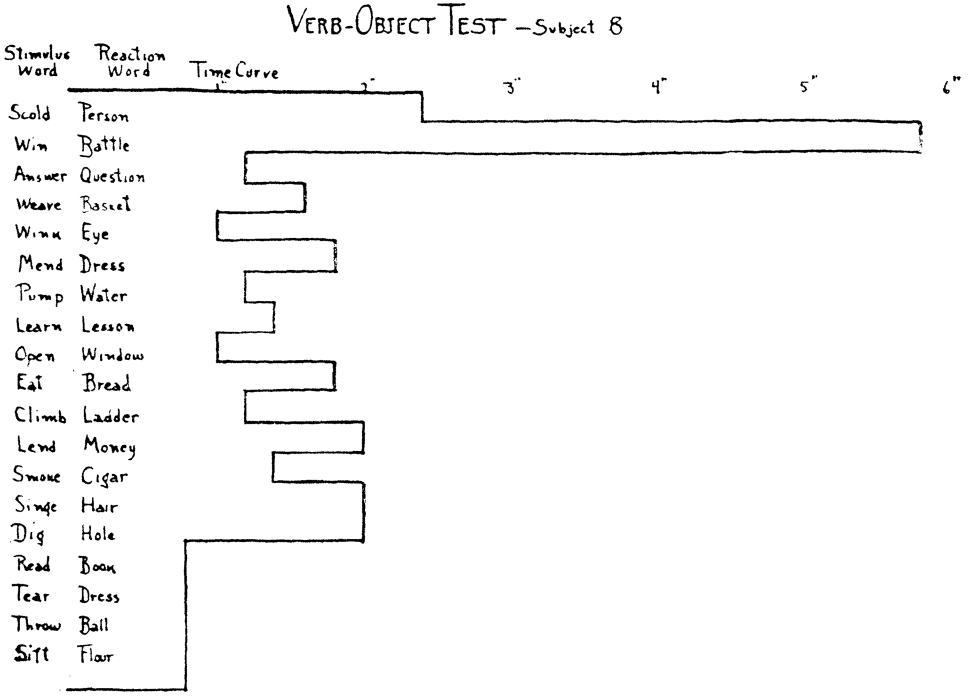

Figure IV. Verb-object test showing conflict, repression, substitution, overlapping or confusion, confession and return to normal reactions. The word *win* brought up a visual image of a valentine with a verse about "winning heart." The subject did not wish to say "heart" because it "sounded silly." "Heart" was therefore suppressed and "battle" was substituted. The effect of this confusion continued to some extent until the subject voluntarily "confessed" the foregoing substitution. The last four reactions illustrate an effectual readjustment.

[2] The records were taken on graphing paper. The length of reaction time was indicated by horizontal lines as shown in figure III, page 419. In eliminating the excessively long reactions a line representing the average time of all reactions was drawn from top to bottom of the chart. The experimenter then estimated the average

The elimination of the abnormal reaction, however, does not in certain cases eliminate the *influence of that particular reaction.* In the case of the word *win,* noted above, the lengthened reaction time is found to be due to a case of conflict followed by suppression and substitution. The subject, who was a young woman, explained the experience as follows: "The word win recalled a visual image of a valentine with a verse about winning heart. Heart sounded silly so I repressed it and substituted 'battle.'" This explanation, however, was not given until sometime after the reaction. Twelve other reactions intervened and the effect of suppression is shown in the disturbed reaction times which follow the conflict. After the twelfth reaction the subject volunteered the explanation given above. The explanation acted as a catharsis to relieve the conflict and a normal adjustment followed as appears from the reaction times of the associations which follow the explanation.

It is evident then that the elimination of the one exceedingly long reaction time does not eliminate the effect of conflict arising in the case of the particular reaction eliminated. A considerable number of the succeeding reaction-times were lengthened with the result that the average time for the whole series is greater than it would have been if the conflict had not arisen. A fair inference from this and similar cases where conflict occurred is that the presence of conflict tends to lengthen not only the total time of a series of reactions but also the average time of the individual reactions exclusive of the particular conflicting reaction in question.

It does not yet appear, however, why this phenomenon of lengthened reaction time due to conflict should make a distinct sex difference. If we turn to the number of conflicts which the two sexes show a reason is apparent. The number of conflicts for the women is greater than for the men in every test but two. For the seven tests the number of conflicts stand in the following ratio:

	Men	Women
Reverse opposites test	3.75	5.
Opposites test	6.25	8.33
Verb-object test	6.6	10.
Attribute substance test	1.2	6.6
Action-agent test	1.2	5.
Agent-action test	3.1	1.6
Subordinate-concept test	6.6	2.5

variation from this line and all reactions that were more than twice this variation were eliminated as abnormal. This method while crude is speedy and served to get rid of the widest variations. It is at the same time more accurate than direct judgment.

It will thus be seen that if the presence of conflict causes a lengthening of reaction time this would account for the women having a longer reaction time than the men in all but the last two tests.

Inasmuch, however, as these last two tests have fewer conflicts for the women than for the men and yet the times for the women are longer a further explanation is needed. This further explanation is found in the presence of less costly conflicts. It must not be supposed that when the long reaction times have been eliminated we have thereby gotten gotten rid of all the cases of conflict. It is perfectly clear from the records of individuals that there were numerous conflicts which did not come under our scheme of elimination. To discover these the following method was used. If a range of fluctuation covering one second is allowed between the lowest and the highest reaction times, it is found that the women tend to transgress this limit oftener than do the men. Thus in the verb-object test the twelve women transgressed the limits of reaction either below or above, almost always above, 64 times while the sixteen men exceeded the one second range only fifty times. This gives a ratio of 5.7 for the women to 3.1 for the men. The ratio of conflicts computed in this way for the other tests is as follows:

	Women	Men
Opposites test	3.5	1.8
Reverse opposites test	2.8	1.3
Subordinate concept test	3.1	1.9
Action-agent test	2.1	1.5
Agent-action test	1.8	.8
Attribute-substance test	1.7	1.2

The ratio for whole group of tests is 21 for the women to 11.6 for the men. Thus it is seen in every one of the logical relations tests the ratio of fluctuations is considerably greater for the women than for the men.

It thus appears that the reason the women fall behind in the logical relations tests is that they were more subject to confusions which produce wide fluctuations in reaction time, the fluctuation being usually in the direction of lengthening the time.

The data at hand do not, however, enable us to judge surely as to the cause of the confusions. It is not probable that it was of the interference type due to overlapping stimulation. This sort of confusion occurred in the tests of Group I especially in the naming tests and there is no reason to

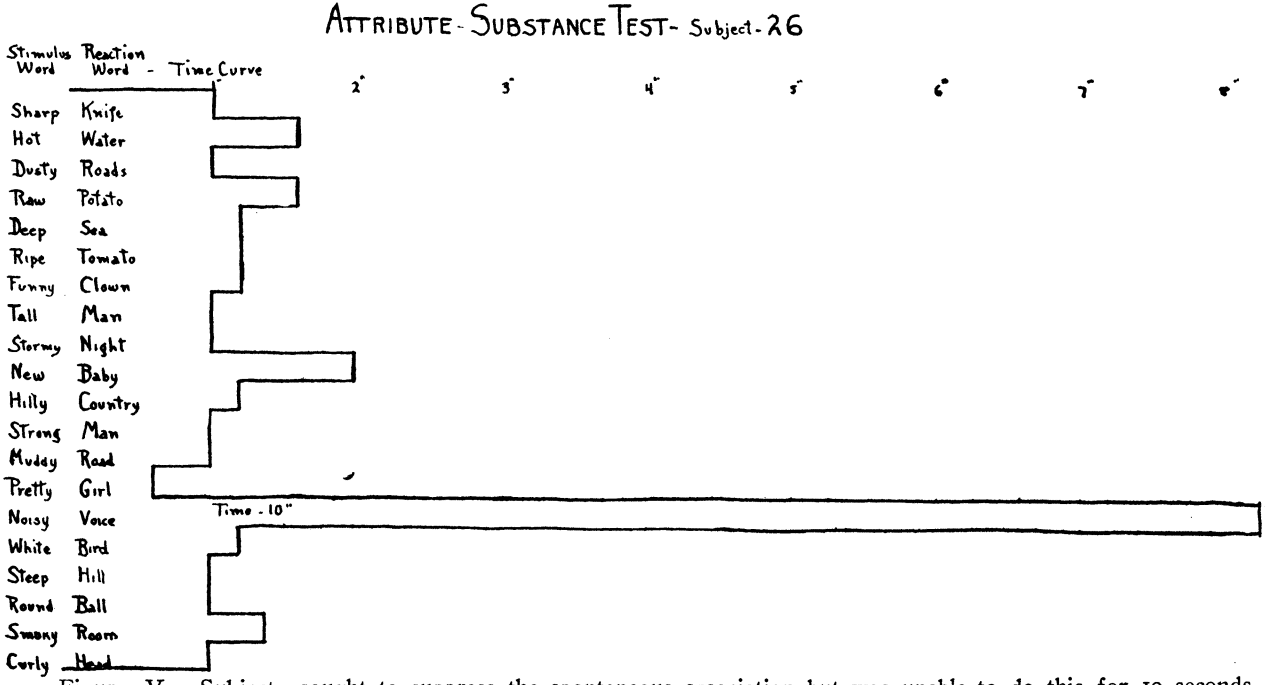

Figure V. Subject sought to suppress the spontaneous association but was unable to do this for 10 seconds when he laughed at his "ridiculous plight." He explained that the word "noisy" brought up a whole constellation of ideas, images, etc., connected with an incident of the previous day. His effort at suppression being unsuccessful, he laughed and the sound of his voice suggested the word "voice" which he spoke.

believe that there is any ground in this sort of confusion for sex differences.

In some of the cases of confusion where we have introspective data the lengthening of reaction is due to the suppression of spontaneous associations and the substitution of secondary associations. The instances in which we have these introspective data are not numerous but they are definite and occur among both sexes. Thus a young man responded "'girl" to the word "pretty" in .6 seconds. To the next word "noisy" he failed to respond for ten seconds and then began to laugh. The sound of his own voice suggested the word "voice" which he spoke. He explained his hesitation as follows: on a previous day he had been giving an association test and used the word "kiss." The subject, who was a young woman, responded "noisy." This had amused him and when the experimenter in this test said "noisy" it brought back the whole constellation of ideas, images, etc., connected with the previous experience. He was unable to suppress the matter entirely and could make no substitution until he laughed at his own "ridiculous plight." This broke the cramped set of mind and he found a word.

If we could infer from such cases that all the confusions were due to conflict, suppression, and substitution we should have to explain why such conflicts were more numerous among the women than among the men. Here are a group of twelve persons whose associative mechanisms in one set of tests work with greater efficiency than those of another group of sixteen persons but who in a second set of tests find their association processes blocked, confused, diverted and inefficient. Analysis indicates that the blocking is due to inhibitions accompanied by emotional excitement. The inhibitions in turn seem due to the tendency of the individual to protect himself from embarrassment. The mind exercises a censorship over its overt expressions suppressing those felt to be inappropriate to the situation and selecting others. This process consumes time with the result that those persons in whom the tendency is strongest occupy the longer time and thus appear by the measure of the tests less efficient than those in whom the tendency is weak.[3]

[3] It should be pointed out that the tendency to be "on guard" would not only influence the length of time in the actual case of conflict but just because the tendency was there it would tend to lengthen the reaction time even though no conflict arose. A mind on guard against self-surprise and self-embarrassment is perforce a slower mind than one from which this tendency is absent or at a minimum.

To reason in the opposite direction, the women, inasmuch as they show the shortest average association time in those tests where no conflicts are possible and the longest average reaction time in those tests where conflict is likely to be frequent must possess the tendency toward suppression to a greater degree than do the men.

Our data, while allowing this as a probable inference, hardly warrant us in asserting it as a proved fact. There are some cases of lengthened reaction where there is no apparent effort to suppress. Thus one person responded "potato" to the word "raw" and remarked that he was fond of potatoes. To the word "new" he said "baby" and noted a recent event in his friend's family. To each of these associations there was a slight emotional tinge which might very well account for the delay of response. Such delays, however, are not likely to be so expensive in time as the cases of suppression and substitution.

Again it might be that differences in imagery might cause differences in reaction time, concrete imagery being more expensive than verbal. This might very well account for individual differences and if it could be shown that the women had more concrete imagery than the men this might have a bearing on the sex differences.

We happen to have the imagery studies made in the course of the class-work. These are not thoroughly accurate, but so far as they go they do not seem to show any sex differences in imagery such as would account for the differences shown in the tests.

However, the conclusions that the differences shown in these tests are due to the greater tendency of the women to be "on guard" against embarrassment can be regarded as tentative only. The fact if it can be shown to be a fact of general application is so important that further investigation along this line should be made. It must be said that the experimental study of adult sex differences has not as yet yielded any very significant results. There seems to be a general conviction that there is a feminine type of mind different from the masculine but in just what this difference consists we have as yet no measured experiments to prove. In view of this lack of scientific data on the matter it seems worth while to set forth the facts and suggestions contained in this paper.